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Modeling Aquarium Equipment
Fish Politics
VorTech - Making Waves
Captive Purity RO/DI

watercolors by Mark Evans

Chief Editor

Terry Siegel
(terry@advancedaquarist.com)

Website and Print Designers

Shane Graber (liquid@reefs.org)
Leonard Ho (len@reefs.org)

Featured Aquariums

D. Wade Lehmann (wade@reefs.org)

Advertising

Leonard Ho
(advertising@advancedaquarist.com)

Cover Photo

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Website & Feedback

Advanced Aquarist:
http://www.advancedaquarist.com/

Feedback:
feedback@advancedaquarist.com

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ADVANCED AQUARIST'S ONLINE MAGAZINE

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EDITORIAL

June 2008

By Terry Siegel

If we don't make this transition what we have to look forward to is very well described in the essay that follows by Bill McKibben.

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Most reef keepers have heard from environmentalists at one time or another that to take animals out of the ocean in order to place them in captivity is a terrible thing to do both environmentally and morally. However, when confronted with this argument, I have responded that it is essentially people like reef keepers, marine biologists, etc. that really care about these sea creatures, learn about their biochemical needs, and will fight for their survival in captivity and the wild. In other words, it is us and folks like us that will fight for the protection of the very environment that the sea flora and fauna evolved in.

Today, we must do just that. Planet Earth, due to the enormous population growth of our species, and our development of industrialization, and modern technology in general are seriously threatening life on Earth as we know it. If we are to have the energy to maintain our reef tanks, along with our modern life style, we must develop alternate energy sources that neither do nor degrade Earth's biosphere. We must deal with global warming. We must move away from the burning of fossil fuels to the production of energy from sources that will not contribute to global warming, like solar and wind power. The technology is now available; what is lacking is the political will to make the transition from the burning of coal and oil to the utilization of wind farms, wide spread use of solar panels, and so on. If we don't make this transition what we have to look forward to is very well described in the essay that follows by Bill McKibben.

The World at 350: A Last Chance for Civilization by Bill McKibben

TomDispatch.com, Sunday 11 May 2008

Even for Americans, constitutionally convinced that there will always be a second act, and a third, and a do-over after that, and, if necessary, a little public repentance and forgiveness and a Brand New Start - even for us, the world looks a little Terminal right now.

It's not just the economy. We've gone through swoons before. It's that gas at $4 a gallon means we're running out, at least of the cheap stuff that built our sprawling society. It's that when we try to turn corn into gas, it sends the price of a loaf of bread shooting upwards and starts food riots on three continents. It's that everything is so inextricably tied together. It's that, all of a sudden, those grim Club of Rome types who, way back in the 1970s, went on and on about the "limits to growth" suddenly seem? how best to put it, right. All of a sudden it isn't morning in America, it's dusk on planet Earth.

There's a number - a new number - that makes this point most powerfully. It may now be the most important number on Earth: 350. As in parts per million (ppm) of carbon dioxide in the atmosphere.

A few weeks ago, our foremost climatologist, NASA's Jim Hansen, submitted a paper to Science magazine with several co-authors. The abstract attached to it argued - and I have never read stronger language in a scientific paper - "if humanity wishes to preserve a planet similar to that on which civilization developed and to which life on earth is adapted, paleoclimate evidence and ongoing climate change suggest that CO_2 will need to be reduced from its current 385 ppm to at most 350 ppm." Hansen cites six irreversible tipping points - massive sea level rise and huge changes in rainfall patterns, among them - that we'll pass if we don't get back down to 350 soon; and the first of them, judging by last summer's insane melt of Arctic ice, may already be behind us.

So it's a tough diagnosis. It's like the doctor telling you that your cholesterol is way too high and, if you don't bring it down right away, you're going to have a stroke. So you take the pill, you swear off the cheese, and, if you're lucky, you get back into the safety zone before the coronary. It's like watching the tachometer edge into the red zone and knowing that you need to take your foot off the gas before you hear that clunk up front.

In this case, though, it's worse than that because we're not taking the pill and we are stomping on the gas - hard. Instead of slowing down, we're pouring on the coal, quite literally. Two weeks ago came the news that atmospheric carbon dioxide had jumped 2.4 parts per million last year - two decades ago, it was going up barely half that fast.

And suddenly, the news arrives that the amount of methane, another potent greenhouse gas, accumulating in the atmosphere, has unexpectedly begun to soar as well. Apparently, we've managed to warm the far north enough to start melting huge patches of permafrost and massive quantities of methane trapped beneath it have begun to bubble forth.

And don't forget: China is building more power plants; India is pioneering the $2,500 car, and Americans are converting to TVs the size of windshields which suck juice ever faster.

Here's the thing. Hansen didn't just say that, if we didn't act, there was trouble coming; or, if we didn't yet know what was best for us, we'd certainly be better off below 350 ppm of carbon dioxide in the atmosphere. His phrase was: "... if we wish to preserve a planet similar to that on which civilization developed." A planet with billions of people living near those oh-so-floodable coastlines. A planet with ever more vulnerable forests. (A beetle, encouraged by warmer temperatures, has already managed to kill 10 times more trees than in any previous infestation across the northern reaches of Canada this year. This means far more carbon heading for the atmosphere and apparently dooms Canada's efforts to comply with the Kyoto Protocol, already in doubt because of its decision to start producing oil for the U.S. from Alberta's tar sands.)

We're the ones who kicked the warming off; now, the planet is starting to take over the job. Melt all that Arctic ice, for instance, and suddenly the nice white shield that reflected 80% of incoming solar radiation back into space has turned to blue water that absorbs 80% of the sun's heat. Such feedbacks are beyond history, though not in the sense that Francis Fukuyama had in mind.

And we have, at best, a few years to short-circuit them - to reverse course. Here's the Indian scientist and economist Rajendra Pachauri, who accepted the Nobel Prize on behalf of the Intergovernmental Panel on Climate Change last year (and, by the way, got his job when the Bush administration, at the behest of Exxon Mobil, forced out his predecessor): "If there's no action before 2012, that's too late. What we do in the next two to three years will determine our future. This is the defining moment."

In the next two or three years, the nations of the world are supposed to be negotiating a successor treaty to the Kyoto Accord. When December 2009 rolls around, heads of state are supposed to converge on Copenhagen to sign a treaty - a treaty that would go into effect at the last plausible moment to heed the most basic and crucial of limits on atmospheric CO_2.

If we did everything right, says Hansen, we could see carbon emissions start to fall fairly rapidly and the oceans begin to pull some of that CO_2 out of the atmosphere. Before the century was out we might even be on track back to 350. We might stop just short of some of those tipping points, like the Road Runner screeching to a halt at the very edge of the cliff.

More likely, though, we're the Coyote - because "doing everything right" means that political systems around the world would have to take enormous and painful steps right away. It means no more new coal-fired power plants anywhere, and plans to quickly close the ones already in operation. (Coal-fired power plants operating the way they're supposed to are, in global warming terms, as dangerous as nuclear plants melting down.) It means making car factories turn out efficient hybrids next year, just the way we made them turn out tanks in six months at the start of World War II. It means making trains an absolute priority and planes a taboo.

It means making every decision wisely because we have so little time and so little money, at least relative to the task at hand. And hardest of all, it means the rich countries of the world sharing resources and technology freely with the poorest ones, so that they can develop dignified lives without burning their cheap coal.

That's possible - we launched a Marshall Plan once, and we could do it again, this time in relation to carbon. But in a month when the President has, once more, urged us to drill in the Arctic National Wildlife Refuge, that seems unlikely. In a month when the alluring phrase "gas tax holiday" has danced into our vocabulary, it's hard to see (though it was encouraging to see that Clinton's gambit didn't sway many voters). And if it's hard to imagine sacrifice here, imagine China, where people produce a quarter as much carbon apiece as we do.

Still, as long as it's not impossible, we've got a duty to try. In fact, it's about the most obvious duty humans have ever faced.

A few of us have just launched a new campaign, 350.org. Its only goal is to spread this number around the world in the next 18 months, via art and music and ruckuses of all kinds, in the hope that it will push those post-Kyoto negotiations in the direction of reality.

After all, those talks are our last chance; you just can't do this one light bulb at a time. And if this 350.org campaign is a Hail Mary pass, well, sometimes those passes get caught.

We do have one thing going for us: This new tool, the Web which, at least, allows you to imagine something like a grassroots global effort. If the Internet was built for anything, it was built for sharing this number, for making people understand that "350" stands for a kind of safety, a kind of possibility, a kind of future.

Hansen's words were well-chosen: "a planet similar to that on which civilization developed." People will doubtless survive on a non-350 planet, but those who do will be so preoccupied, coping with the endless unintended consequences of an overheated planet that civilization may not.

Civilization is what grows up in the margins of leisure and security provided by a workable relationship with the natural world. That margin won't exist, at least not for long, this side of 350. That's the limit we face.

Bill McKibben is a scholar-in-residence at Middlebury College and co-founder of 350.org. His most recent book is The Bill McKibben Reader.

FEATURE ARTICLE

Google SketchUp for Aquarium Applications, Part II

By Shane Graber

In this second part, Shane digs a bit deeper into using SketchUp for modeling aquarium projects. You will learn a bit about using scripts to automate tasks as well as to add new functionality to SketchUp while building a kalkwasser reactor.

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In the previous installment, I introduced the Google SketchUp software to the reader, went over installation, basic usage, and created a 120 gallon aquarium. In this installment, we will continue building models for our 120 gallon aquarium and will build a simple Deltec kalkwasser stirrer. This kalkwasser stirrer was chosen due to its straight-forward design which should make it relatively easy for the reader to model as they read through this article.

For reference, you can download both the individual parts and the completed model and look it over while you're reading through this article. I've omitted some of the detail in the stirrer in order to keep this article easy to follow along. Scroll and pan around both model files to see it from different angles to get a feel for how things look in the software.

If at any time things don't quite make sense on what's being presented, please refer to the previous article or look around the SketchUp Help Center . They can go into a lot more detail than what I can in this short article.

Scripting

A new topic that we will learn about in this article is the use of scripts and plugins in SketchUp. Scripts and plugins are very powerful and they are used to automate various tasks and add new functionality to the program. There's a lot of useful scripts out there that can be used to create all sorts of different designs. I won't go into detail on how to create your own in this article as there's plenty of tutorials on the web. I will, however, introduce two scripts that I've found to be very useful when working with aquarium modeling. The first is called "Pipe Along Path" and the second one is called "Centerpoint." The "Pipe Along Path" script is an awesome script that allows you draw anything that looks like a pipe or a rod. You essentially draw a line (or series of lines) and then using the script you can either create a cylinder out of it or create a pipe with a specific outer and inner diameter. It can be used for creating plumbing diagrams, modeling skimmers or just about anything that requires a tubular component. You can even set the number of sides that your pipe/tube has when rendered so if you wanted to make rectangular tubing you could do that easily with this script. The "Centerpoint" script is a nice helper script that plots a centerpoint on any surface that's selected -- square, circle, triangle, etc. This is useful when you want to place an object in the exact center of another object. We will use both of these scripts extensively in this article.

Installation

Let's go over getting and installing the two scripts. It's really pretty simple. For the "Pipe Along Path" script, download (right click, SAVE AS) the script from The Ruby Library Depot and save it to the Plugins directory of your Google SketchUp installation. On my system, the path is "C:\Program Files\Google\Google SketchUp 6\Plugins\". Next, let's download the "Centerpoint" script from Smustard and save it to the same location that you saved the "Pipe Along Path" script to on your computer. After you've saved both scripts to that directory, start SketchUp (or restart it if you already have it running). Now if you navigate to the Plugins dropdown menu, you'll see an entry for "Pipe Along Path" and another one for "Set Center Point." Once that's complete, we're all set to go.

Let's Dig In

Here is a photo of the stirrer that we will be creating in this article:

I chose this kalkwasser stirrer for its relatively straight forward design and ease of modeling. Per Deltec's website, this unit is 6" L x 6" W x 19" H. I've had to do some estimations on the dimensions for certain items (baseplate thickness', tube heights, etc) as they were not readily available from their website but they should be close enough for this article.

Generally, the easiest way to go about creating a model like this is to make each of the components separately and then stack them together later in the process. The one thing that we will not model in this installment is the power cord. Having it in the model would finish it out, but it's really not necessary for what we're working on here, which is to roughly model a piece of aquarium equipment.

Since it's been a while since the first article, please skim over the previous article to get a feel for the interface again and what each of the icons mean and do.

Let's Get Started

The first thing we will do is make our components. I've already measured out what needs to be made in the below components list:

1. Baseplate (1): Square, 6" L x 6" W x 0.25" H
2. Caps (2): Circle, 5.5" diameter (2.25" radius), 0.25" H
3. Motor (1): Box, 2" L x 2" W x 1.5" H
4. Stir Bar Top (1): Cylinder, 2" H, 0.75" diameter
5. Motor Housing (1): Tubing, 2 5/16" H, 5" diameter
6. Kalkwasser Chamber (1): Tubing, 15 5/16" H, 5" diameter
7. Kalk stir rod (1): Tubing, 3" W x 12.5" H, 0.25" diameter
8. Freshwater Input (1): Cylinder (on its side), 1.5" long, 1.5" diameter
9. Kalkwasser Exit Nozzle (1): Cylinder (on its side), 1.5" long, 1.5" diameter

Deltec Kalkwasser Mixer KM500T. Photo courtesy Deltec.

Using what you learned from the previous installment, make components 1, 2, 3, 4, 8 and 9 from the above list in a new SketchUp project window. If you'd rather not make each of the shapes, again the finished individual components can be downloaded instead.

After you've made the components, we're going to add center points to each face. Using your Select arrow tool, select the top of your shape by clicking on it. Now click the Plugins dropdown menu and select "Set Center Point." A center point should now be added to your surface. Now using the Orbit tool, rotate your view so that you're now looking at the bottom of your shape. Again, using your Select arrow tool, select the bottom of your shape and setting a center point on that face as well. So far, so good.

After you've completed each shape, use the "Select" arrow tool to select the shape (mouse click and hold at the upper left of the shape and drag down to the lower right to select the entire shape or triple click on the shape to select all of it), right click on the selected shape and choose the "Make Component" menu item, and then Name it and click the Create button. This binds the shape into a complete unit that is easier to work with later.

When completed with this step, you'll have six shapes created: one baseplate, two caps, one motor, and two ports each with center points on their top and bottom faces. Next, we will get to making some tubing.

Making Tubing

Items 4 and 5 will require us to use the "Pipe Along Path" script in order to make the desired components. In order to get started on these two items, we need to move the components that you

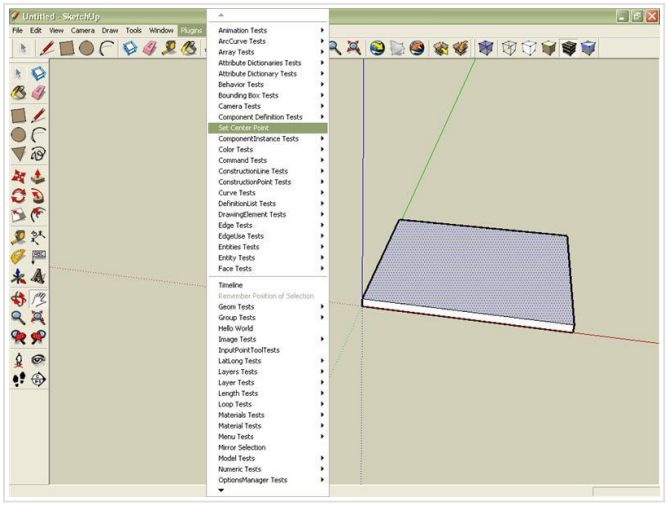

Photo 1: Making a center point on the top surface of a shape.

made in the previous section away from the origin (the point where the red, green, and blue lines intersect). Again using your Select arrow, click and drag across all of the components that were made in the previous step to select all of your shapes near the origin and then use your Move/Copy tool to move them away from the origin.

Now that that space is clear, let's make our Kalkwasser Chamber. Using your Pencil tool, start by clicking at the origin of the three axes in your interface. Drag that up a bit and then type the following into the window:

15 5/16"

This creates a line 15 5/16" tall. Next, select the line with your Select arrow tool and then click on your Plugins dropdown menu and select Pipe Along Path from the menu items (Photo 4). Make sure your units are in "Inches" and that your tube has an outer diameter of 5 inches and an inner diameter of 4.5 inches. Leave the Number of Circle Segments at 24 and click OK. You now have a tube (Photo 5).

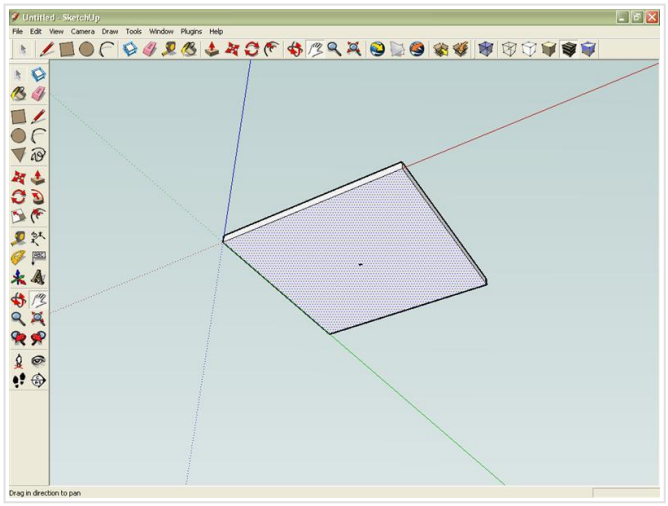

Photo 2: Making a center point on the bottom of a shape.

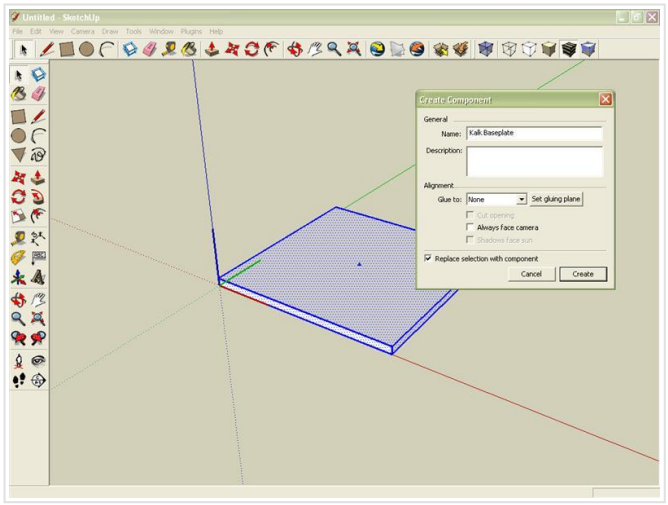

Photo 3: Making a component out of a shape.

Again, either triple-click on the tube or use your Select tool to drag across the entire tube to select it and then make a component out of it. With that done, move it away from the origin so we can make the Motor Housing.

Now, create the Motor Housing the same as you did above. The motor housing is the same inner and outer diameter as the Kalkwasser Chamber except that it is only 2 5/16" tall.

The stir rod was created in a similar fashion as the above tubes except that its outer diameter is 0.25 inches and its inner diameter is zero inches. A lot of smaller line segments were pieced together to make it. Use your Line tool (pencil) to make line segments that are attached per the dimensions mentioned in the above components list and then triple click on the line with your Select tool to select all of the line segments. Now use your Pipe Along Path plugin to make it 0.25 inches outer diameter and 0 inches inner diameter.

Now your stir bar is created! Make a component out of it and we can proceed to the next step.

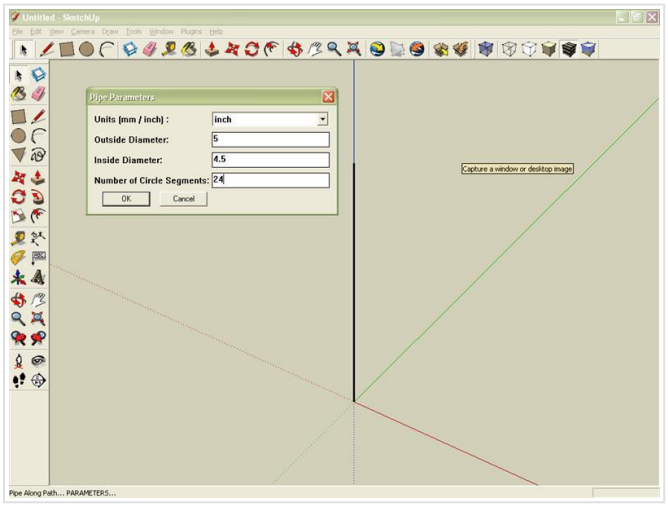

Photo 4: Pipe Along Path dialog box

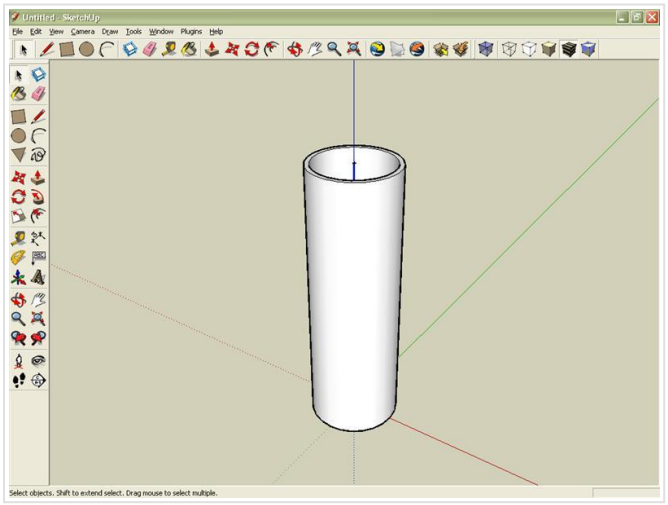

Photo 5: Your finished tube!

Putting It All Together

Now that all of the components have been made, we need to put them all together. The first step in this process is to fill each of the components with color/transparency. To do this, click you Paint Bucket icon on your menu or select the Tools menu followed by Paint Bucket. Fill items 1, 2, 8, and 9 from the above list with either a dark black or a gray color. Items 4 and 7 should be filled with a red color. Item 3 can be filled with a light gray. For items 5 and 6, switch to "Translucent" from the Paint Bucket dropdown box and fill these two items with "Translucent_Glass_Blue." I have done so with the individual components file that you downloaded earlier and you can get it here in case you'd like to see how I've done it.

The next step is to start assembly. The easiest way I've found to assemble everything is to switch into Wire frame mode (View - Face Style - Wire frame menu items) and then begin the moving and stacking process.

Next, switch to your Move/Copy tool (Tools - Move menu items) so that we can begin assembly. The first thing we will do is assemble the completed Stir Rod. Grab item 4 (Stir Rod Top) by the bottom centerpoint and drag it up and place its centerpoint on top of item 7's centerpoint (Stir Rod). You may need to switch in and out of Pan and Zoom modes to get in close enough to see the centerpoints and how they line up. When done it should look like Photo 11.

Continue assembly by stacking the components using their centerpoints as a guide until you end up with what the completed model looks like. It may take a while to get the hang of it, but by switching between Pan mode, Orbit mode, and Move/Copy mode, you'll get all the pieces together into one unit. You will end up with something that looks like Photo 12 after you've switched out of wire frame mode.

Conclusion

And there you have it, a model of the Deltec KM kalkwasser stirrer. If you have time to play, you can go into much greater detail than I have been able to in this article. You could add the extension cord as well as make the infeed/output ports more realistic or whatever your heart desires.

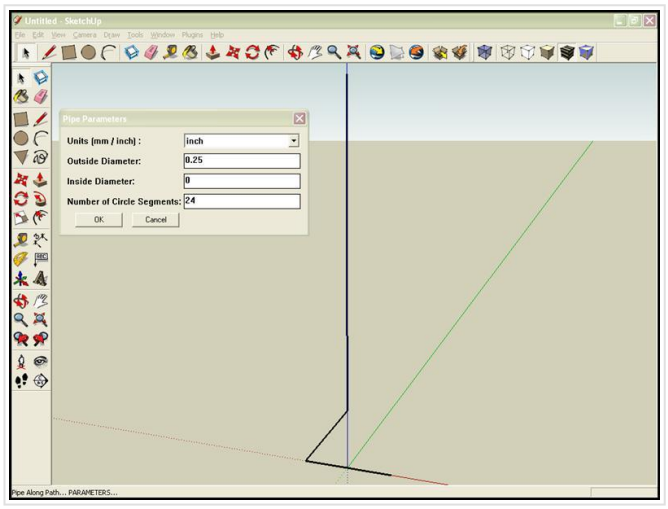

Photo 7: Selected stir rod.

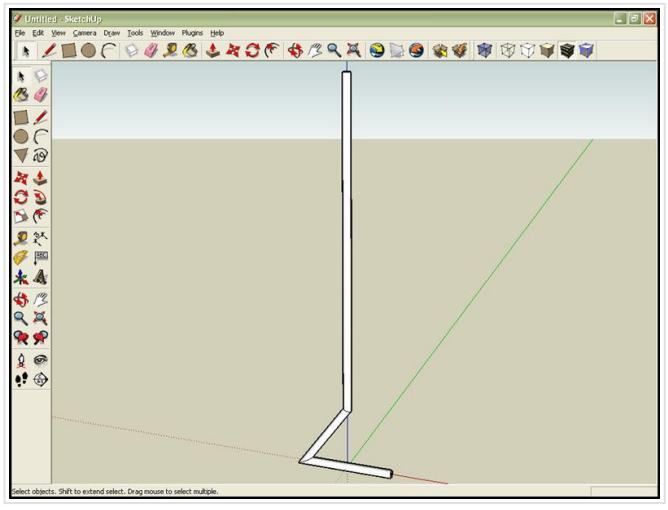

Photo 8: Final Stir Rod.

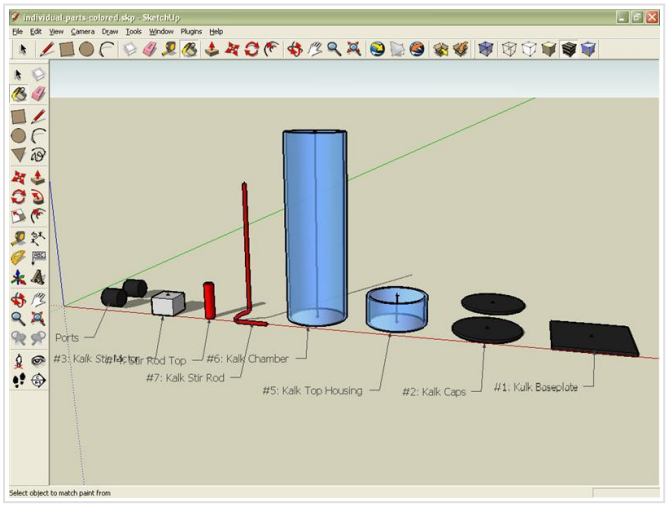

Photo 9: Components after shading.

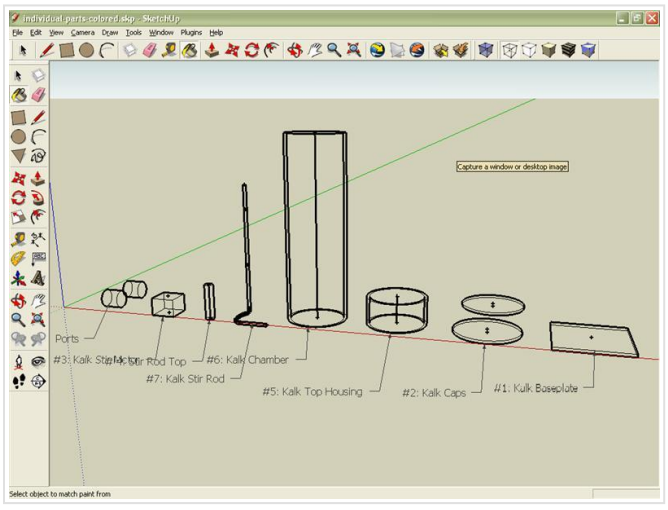

Photo 10: Wire frame mode.

Again, I'd like to challenge any and all of the aquarium manufacturers to provide SketchUp models of their equipment for hobbyists like us to use when mocking up our "dream systems." We could quickly switch in and out various pieces of equipment and see what works and doesn't work for our specific needs. I'd also like to challenge the other hobbyists to create SketchUp models and share them with others so they can also benefit. Again, reefs.org has a repository setup for it or else share it on Google's repository. The big thing is to get them out there for people to use.

Further Reading

If you'd like to dig deeper into SketchUp, there's an excellent book available from Amazon.com on the subject:

Google SketchUp for Dummies
Chopra, Aidan, Wiley Publishing, Hoboken, NJ, 2007
ISBN: 978-0-470-13744-4
$25 (list price)
$16.50 (street price)
Website: Click here

A review of the book can also be found at PC World's blog for those wanting to read some additional information on the book before purchasing it: http://blogs.pcworld.com/communityvoices/archives/2007/11/book_review_goo.html

Acknowledgements

I'd like to thank Adam Blundell for encouraging me at this past MACNA XIX to continue with this series.

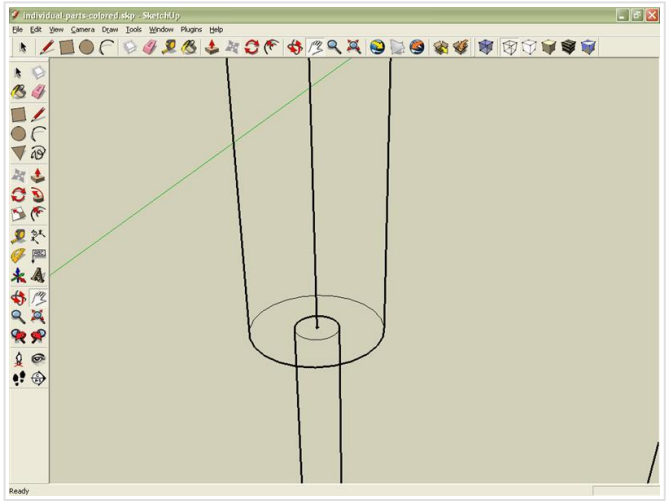

Photo 11: Items 4 and 7 centered on their centerpoints.

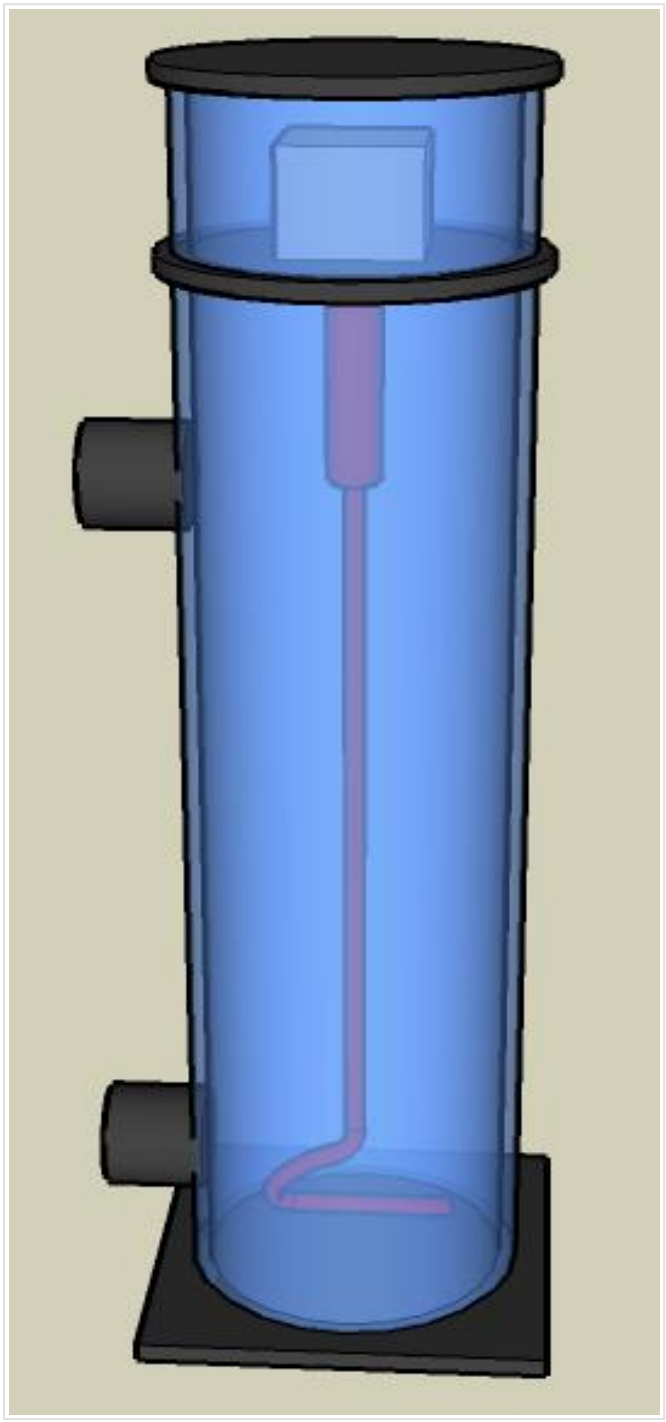

Photo 12: The completed unit!

REEFKEEPING EVENTS

What's Happening in Your Area?

By Advanced Aquarist Readers

Check to see if an event is happening in your area!

Published June 2008, Advanced Aquarist's Online Magazine.
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Keywords (AdvancedAquarist.com Search Enabled): Advanced Aquarist Readers, Reefkeeping Events
Link to original article: http://www.advancedaquarist.com/2008/6/events

Do you have an upcoming event?

If so, please email us at feedback@advancedaquarist.com and let us know about it!

Summary of Upcoming Events

1. Rochester Minnesota Marine Aquarium Club (RMMAC) Community Meeting, July 20
2. Chattanooga Reef Club Frag Swap, August 16
3. Reefkeepers Weekender, August 29 - September 1
4. MACNA XX, September 5 - 7
5. West Tennessee Frag Swap and Aquarium Show, September 27
6. Southern Colorado Marine Aquarist Society Frag Swap, October 4

Rochester Minnesota Marine Aquarium Club (RMMAC) Community Meeting, July 20

When: Sunday July 20th 5:00PM
Where: Exotic World of Fish, 1137 6th Street NW, Barlow Plaza, Rochester, Minnesota 55901
Phone: 507.424.1690
Website: http://www.thereeftank.com/forums/f79/rmmac-sunday-july-20th-community-meeting-details-117375.html

Agenda:

- 5:00PM-5:30PM Dinner & Social + Sell Raffle Tickets
- 5:30PM-5:45PM EWOF Store tour & talk by EWOF
- 5:45PM-6:00PM Do It Yourself (DIY) water top off system, by Brad O.
- 6:00PM-6:15PM Raffle Drawing
- 6:15PM-6:30PM Club Business

Tickets will be sold for $5 per ticket. At 6:00PM tickets will be drawn, with the first ticket drawn being the first to pick from the raffle items, second second, and so forth. If there is nothing left that a person wants, the next ticket is drawn. All money taken in will be RMMAC club funds to use in promoting & growing RMMAC and other club uses. There is a limit of ONE gift certificate per person as a prize.

Raffle Items (more to come):

- $20 EWOF Gift Certificate
- $20 EWOF Gift Certificate
- $20 EWOF Gift Certificate
- 10-20 lbs of aragonite base rock in a free bucket donated by Ben (Ben E.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 2 heads - donated by mjsandbe (Michael S.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 4 heads - donated by mjsandbe (Michael S.)
- Blue Candy Cane Coral Frag (Caulastrea furcata) 4 heads - donated by mjsandbe (Michael S.)
- Metalic Green Millipora Frag - donated by mjsandbe (Michael S.)
- Orange Montipora Frag- donated by mjsandbe (Michael S.)
- Tri-Color Acropora Small Frag - donated by mjsandbe (Michael S.)
- Tri-Color Acropora Small Frag - donated by mjsandbe (Michael S.)
- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)
- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)
- Plum/Purple Montipora Digita Frag - donated by mjsandbe (Michael S.)
- Kalkwasser Reactor - donated by mjsandbe (Michael S.)

Rochester Minnesota Marine Aquarium Club (RMMAC): Our purpose is to enhance the hobby, and grow a community, by promoting the exchange of information, equipment, and livestock. We are located in SE Minnesota, centered on Rochester, and we welcome all to join from the surrounding areas.

Chattanooga Reef Club Frag Swap, August 16

When: August 16, 12:00 PM - 4:00 PM EST
Where: Ooltewah United Methodist Church, 6131 Relocation Way, Ooltewah, TN 37363
Website: http://www.reef2reef.com/forums/showthread.php?t=10762

The Chattanooga Reef Club and its members would like to invite you to their annual Frag Swap! Join fellow reefers from around the region for this 7th installment of this event. Buy, sell, trade, or browse coral and equipment! Meet other reef hobbyists from all around the Southeast and enjoy this time of fun, fellowship, and of course some major fragging!

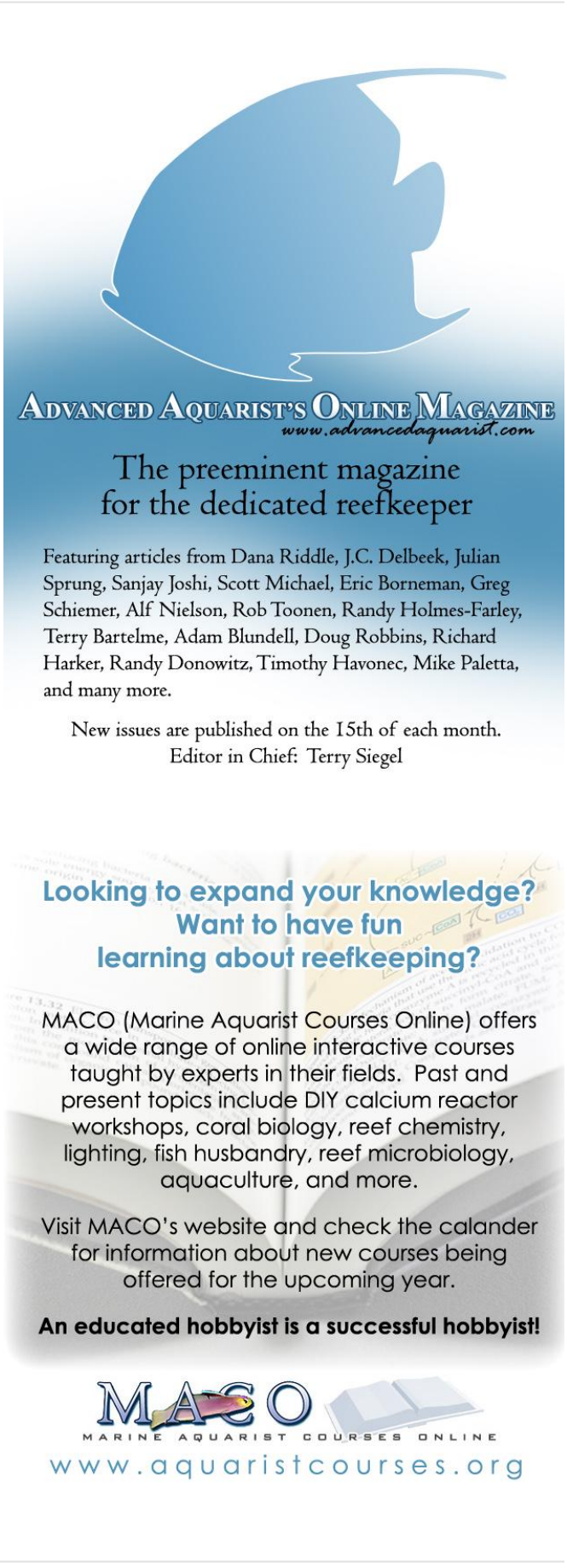
- Buy, sell, and trade coral and equipment
- How to frag coral demonstration
- Cost is $1 for card carrying club members, $3 for non-club members, and $10 to rent a table to sell.
- Dozens of commercial and hobby level sellers and traders.
- Many raffle prizes including skimmers, lighting, gift certificates, frags, and much more.
- Concession stand style food if you get hungry!
- Everyone is welcome to attend!

We are very excited about this year's swap! We have Dr. Mac from Pacific East Aquaculture coming with 100's of corals, Dennis Tagrin of DT's Plankton Farm, Randy Reed from Reef Nutrition/ Reed Mariculture, Matt Carberry From Sustainable Aquatics and a few more in the works. There are donations to be raffled off from several major companies including Red Sea, Seachem, Reef Geek, Current, Hamilton Technology, AirWaterIce, Reef Doctor Micromussas, Cherry Corals, Carib-Sea and more to come!! We hope to see you all there!!

Reefkeepers Weekender, August 29 - September 1

Date: Friday, August 29 through Monday, September 1, 2008
Location: Pontins, Pakefield, Suffolk (2 hours from London, 3 Hours from Birmingham)

The Reefkeepers Weekender has grown steadily since it's inception, and last year was a really fantastic weekend, with superb presentations, a Quiz, brilliant raffle prizes, cabarets, plenty for the kids, and LOTS of late night chat (and a fair bit of Resolve sold in the shop!).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Featuring articles from Dana Riddle, J.C. Delbeek, Julian Sprung, Sanjay Joshi, Scott Michael, Eric Borneman, Greg Schiemer, Alf Nielson, Rob Toonen, Randy Holmes-Farley, Terry Bartelme, Adam Blundell, Doug Robbins, Richard Harker, Randy Donowitz, Timothy Havonec, Mike Paletta, and many more.
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Editor in Chief: Terry Siegel
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Visit MACO's website and check the calander for information about new courses being offered for the upcoming year.
An educated hobbyist is a successful hobbyist!
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The highlight of the weekend will be, in additon to the usual raffle and quiz, presentations by none other than world renowned experts:

- Mr Anthony Calfo, Author of two of the "Bibles" of reef keeping, "The Book of Coral Propagation" and "Reef Invertebrates" amongst others. Anthony has also recently had articles in "Ultra Marine" magazine.
- Top Dutch expert, Mr. Ron Hessing. Ron writes for Koralle magazine in Germany, A Journal in the USA, and his own site www.marineaquarium.nl and has spoken publically at events around the world, most famously, MACNA and the Boston Reefers Society.

As well as these eminent experts, there will be other presentations, to be confirmed. Details of what their presentations will be will follow a bit nearer the time.

It is essential that you book now if you want to come this year. Last year, the holday park was full, and some of those that wanted to come were disappointed. So, don't delay your decision this time people. It is bound to be over subscribed with a line up like this, so get in there and secure your place. You need to contact Pontins, Pakefield to book on 01502 502 900. Tell them it is for the Reefkeepers Weekender, and make sure you give them your UR name as well your real one, so that we can issue badges.

For 3 nights Fri, Sat and Sun, it is £60 and half price for Under 18's. This is half board, so a full Breakfast and Evening Meal each day are included. There will be Trade Stands and Give-aways too, and, of course, a chance to meet up for our annual chin wag and party! You do need to book this now! It has become one of the leading UK meets of the year and you don't want to miss it!

MACNA XX, September 5 - 7

Date: Friday, September 5 through Sunday, September 7, 2008
Location: The Westin Peachtree Plaza, 210 Peachtree Street, Atlanta, Georgia 30303
Website: http://www.macnaxx.com

Presented by Atlanta Reef Club and MASNA, MACNA is the largest hobbyist marine conference in North America. New aquarium products, vendors will often wait until MACNA to release new products into the hobby. Hobby professionals, you will have a chance to meet and mingle with professionals in the hobby like Eric Borneman and Anthony Calfo. A chance to be at a conference with hundreds of other people just as obsessed with aquariums as you are.

We have selected the Westin Peachtree Plaza as the host hotel for this event. It is the tallest hotel in the western hemisphere. Our negotiated room rate is $119.00 per night with discounted parking. Everyone that stays in the hotel will be given free internet access from their rooms.

This 73-story tower, topped by the revolving Sun Dial Restaurant, Bar & View, graces the heart of Atlanta. Connected to AmericasMart, The Westin Peachtree Plaza, is steps from CNN, Georgia Aquarium, Georgia World Congress Center and the Georgia Dome.

Contact Information:

MACNA XX
1266 West Paces Ferry Rd.
Suite 194
Atlanta, GA 30327
PHONE:
FAX: 860.540.2351
E-mail: info@macnaxx.com
Contact Form

West Tennessee Frag Swap and Aquarium Show, September 27

When: Saturday, September 27, 10 AM - 4 PM
Where: 5719 Quince Rd, Memphis, TN 38119 (map)
Phone: 901-359-2199
Website: http://www.wtmrac.org/newfragswap.htm

Come learn more about the marine reef and aquarium hobby. Admission is $3/person. Coral frags for sale or trade. Great raffle prizes! Frag Demo. Table space available for $15 (reserve in advance).

For more information, either call 901-359-2199 or email klug3@comcast.net.

Southern Colorado Marine Aquarist Society Frag Swap, October 4

Date: Saturday, October 4th, 2008
Location: Crowne Plaza Hotel, 2886 South Circle Drive, Colorado Springs, CO 80906 (map)
Website: http://www.scmasfragstock.com/

The SCMAS FragStock will take place on October 4th 2008 at the Crowne Plaza Hotel in Colorado Springs Colorado. This event will feature Marine Livestock (no Fish) and Dry Goods vendors from Colorado as well as national vendors from around the country. The event will take place in the Salon A Grand Ballroom and feature raffle items and amazing corals. Check back frequently as vendors are added to the list. We will also be listing the Raffle items on this site as well. Below is the event layout (subject to change) and some pictures of the Hotel. For more information or if you would like to be a vendor please send an email to Ldogg@thescmas.com.

AQUARIUM FISH

FISH POLITICS

By Mark E. Evans

We can expect a newly introduced fish to "follow" the general "specifications" and behavioral characteristics of the species to which it belongs. But what the possible behaviors are going to be under all circumstances is the million-dollar question.

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Imagine you're a male seahorse clinging to a strand of algae, swaying rhythmically in the current. Zooplankton drifts by and you snap it up in your narrow mouth. There are several female seahorses nearby for you to court. Also, there are a few males, who are the competition. But the males are mostly peripheral to your territory and of little or no concern. Overall you are content. Everything you require either drifts to you or is in short swimming distance from you. Your world is small but complete. Until one day, to your consternation, you are collected by a marine biologist and set up in a laboratory tank, far away. Your world is suddenly much smaller and very different. Your tank mates now include a single female and several males, all from your species. The males set about bullying you, because you are the now in direct competition for the female's attention.

You continue your existence as a male seahorse inside a lab tank, which is a drastic change of environment from your wild "stomping grounds." Your new captive environment elicits behavioral changes in you and your tank mates, the other seahorses. Yet you are all still the same animals, from the same species. And neither you nor your fellow seahorses have been genetically altered in any way. It's just that the new environmental conditions require different behavioral responses. Although you still have access to a "hitching post," food, and a female, your territory is cramped and too close for comfort to the other males who are competing for the same resources. Your whole world is now in miniature and the neighbors are encroaching upon your "yard," or you are encroaching upon theirs. Either way the cramped living conditions lead to some conflict. Whether it is mortal combat is determined by the degree of environmental change and how genetically prone you are to defending your space. It is the combination and the interaction of the two factors, environment and genetics, which makes you, the seahorse, who you are.

You may be a member of unique species of seahorse, with genes in common with your conspecifics, but within your species you are a unique individual with your own DNA, similar overall, but dissimilar. (In a given species individuals possess enough of a genetic difference to create a range of characteristics and behaviors. For example, in the extremes one individual fish from a population may be the most aggressive while another is the least aggressive, with the rest of the population falling somewhere in between on the scale.) But it's not only you who are unique, so is the environment in which you live, the aquarium. Not just physically but genetically. All your other seahorse tank mates are genetically unique. So, no other aquarium environment exactly matches yours.

A captive seahorse's perspective helps us to better appreciate the uniqueness of aquarium setups. Each aquarium is a unique environment, housing genetically unique individuals, arranged in a unique configuration, at least to a certain degree. Biological traits or behavioral characteristics often follow a bell curve, from the least to the most. In a population, the difference between individuals is subtle, continuing along a grade; for example, from the most aggressive to the least aggressive. The grade may manifest itself by beginning with 'indifference' followed by 'mild

chasing' then 'blatant aggression', and ending with 'outright killing'. (Researchers have determined that in some species of schooling fish the position of individual fish in the school is influenced by fear levels, the most fearful keeping to the inside the school.) The average behavior for a species determines the shape of the curve. (See Different Bell Curve Diagrams: Different species, more aggressive, less aggressive, different shaped curves). But although we might confidently generalize a single species' behavior, we are dealing with uncertainty when species are combined. Published compatibility charts are built on experimentation and experience, but in reality they are only guidelines. Our own observations are key. Several points we should keep in mind when attempting to minimize fish aggression include - size, sex ratio, color, shape, food, territory, and population density. For simplicity's sake, I will sort them into two basic categories: territory and food. The categories sometimes overlap, and they are both altered by the factor of time.

Consider the allocation of space in the average reef aquarium, and the possible areas where conflict can occur between fish. Reef walls create nooks, crannies, caves, passageways, crevices, and perches. In addition, a deep sand bed below the rock offer space for burrowing fish species. But territoriality is relative. One fish may defend a small cave, while another may lay claim to the entire tank's swimming space. But we must remember that it is the layout of the space together with the genetic proclivities of the fish that determine whether or not conflict is inevitable. Each individual fish is a unique genetic package. And as aquarists we assume a degree of uncertainty when we introduce a new inhabitant to our aquarium.

However, we can expect a newly introduced fish to "follow" the general "specifications" and behavioral characteristics of the species to which it belongs. But what the possible behaviors are going to be under all circumstances is the million-dollar question. The previous story of the captive seahorse reminds us of that. The fact is that captive and wild behavior can differ greatly. The limits of an aquarium environment and the potential interactions with tank-mates can alter how a fish "should" behave. The number of environmental variables involved combined with the flexibility of chemical responses (genetically determined) allows for deviation in fish behavior. We can expect common aggressive reactions between two fish species to occur, like a Purple Dottyback reacting negatively to a fish of a similar size and color. But what effect does the presence of a third fish species have to the mix? Will it nullify or amplify the conflict, or will it simply have no effect at all? Will a juvenile species be more aggressive and territorial when it matures or will it relax its guard? The famous paleontologist George Gaylord Simpson wrote "... [T]he development of the individual is affected not only by the inherited growth determinants but also by the conditions under which growth occurs." (Simpson).

So, no one can answer these questions with certainty? In an aquarium the interactions between multiple species is as complex as a wild ecosystem. Finally, we must realize that animals change their ecosystem simply by being present and living in it. My very first marine tank, which I got when I was twelve, contained two Blue Yellow-Tail Damsels, both of which expended time and effort excavating the sandy bottom with their tails, to the point of creating a cave under a large rock. I repeatedly pushed the sand back, but they always rebuilt. Thus the two Damsels not only affected their world, but mine as well. I hated seeing the bare patch of tank bottom showing, and my aggression was slightly stirred by their behavior.

Consider the ubiquitous Yellow Tang (Zebrasoma flavescens). As an herbivorous schooling species it patrols an aquarium searching for algae. (Herbivores generally must eat meals more often than carnivores because plant material is harder to digest than animal flesh. Consequently, herbivorous species like the Yellow Tang possess longer intestinal tracts than carnivores, and they exhibit greater territorial behavior to protect their food resources.) Therefore, a conspecific, if present, is the most immediate threat. Two individuals of the same species, which are of a similar size and "disposition," are likely to intimidate one another until a hierarchy is established. Competition for the same resources leads to conflict both in the wild and in the aquarium.

Because space is inherently limited in an aquarium, territorial conflict is a common problem. Fish like gobies, blennies, clownfish roam, but center activities around a prime location such as a pit or a cave, defending a small circumference of territory. Conversely, a fish like a puffer that requires greater space may claim the entire tank as its territory, attacking meeker fish or chasing them into hiding. I remember seeing aerial news footage of a shark swimming through a school of small fish. The small fish kept their distance equally on all sides of the shark, creating an almost perfect oval around the shark, like an invisible shield. Fish require their space, and they will create it if necessary by altering their surroundings, through modification of the physical environment or by intimidating or killing their tank-mates. As aquarists we have to utilize an aquarium's space as conservatively as

possible, simulating the wild reef while balance our esthetic desires with the requirements of the fish.

Simple Steps For Avoiding Deadly Conflict Between Fish:

1. Keep a watch on fish with similar swimming levels, similar shapes, or colorations. Conflict may erupt if they are of the same species and a hierarchy is under development Different species may need to established a sense of their own territories.

2. Conflicts over food may be reduced by feeding smaller portions more often, or in the case of algae eaters, by creating more than one feeding "station", for the algae to grow or to be clipped to. Similarly, changing the area of the tank where live foods are released or injected may reduce fights over which fish eats first.

3. If a fish is biting or serious injuring a tank-mate, try feeding it more often, or providing it with fresh meaty foods.

4. Shift the physical environment of the aquarium. Relocate rocks or plants to disrupt territorial claims. If a new fish is to be introduced, changing the décor around breaks up previously held territory, giving the new inhabitant an equal opportunity to establish a claim.

5. Try feeding at random times, and at different locations within the aquarium, if you are hanging food from clips or inserting food at specific locations.

6. Change the duration of the lighting. "Lights Out" may force bullies to clam down. And nocturnal fish require their time too.

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LATERAL LINES

Making Waves With The EcoTech Marine VorTech

By Adam Blundell M.S.

While water motion will forever be debated, we can all agree that having options on water flow is always great. Thankfully we now the ability to produce water flow in all sorts of varieties.

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Keywords (AdvancedAquarist.com Search Enabled): Adam Blundell M.S., Lateral Lines, Pumps, Water Circulation
Link to original article: http://www.advancedaquarist.com/2008/6/lines

The VorTech kicks ass and here's why: you can make waves, you can control the waves, and you can customize your flow. Is that enough reason for you? If not here we go.…

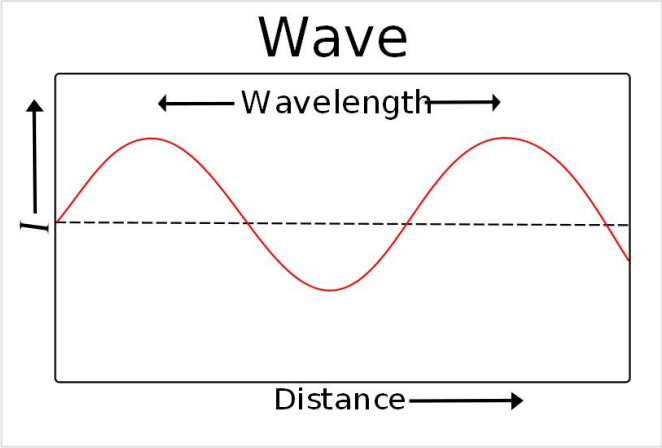
The Basics of Waves

Well this is a whole can of worms to open here. In this article I want to cover some terminology and basics of waves. Future articles (Adams & Blundell) will go into depth covering the mathematics and dynamics of waves.

Wavelength is the name for a measured distance. It is the distance from one spot on a wave until the next point where the spot occurs. Did that make sense? In other words it would be the distance from the top of wave to the top of the next.

Amplitude

Amplitude is also a measurement of distance. The amplitude is a measure of how high (or low) a wave moves from the baseline. This measurement is magnitude of disturbance from that baseline. Note- many people are confused on this because the amplitude is measured from the baseline, and not from the peak of a wave to the trough of a wave. If you are measuring from the top of the wave to the bottom you are actually measuring 2x the amplitude.



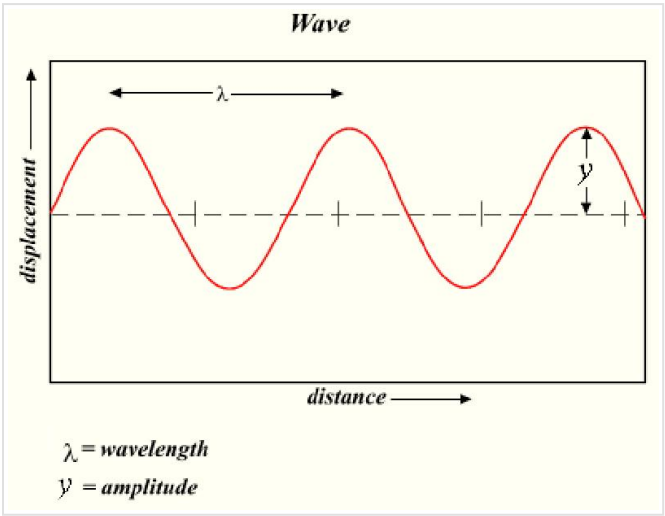
Wavelength. Picture courtesy of Wikipedia

Frequency

Frequency is a measurement used in time. Frequency measures how many waves are produced during a certain amount of time. You could measure frequency in number of waves per 3.721 seconds, or number of waves per 11.184 minutes, or number of waves per full moons. To make things easy scientists prefer to measure frequency in number of waves per second or per minute. It is a measure of how often something occurs.

Waves in Aquaria

Waves have been absent from most home aquariums. A dump bucket or surge device can be used to create a transverse or traveling wave. But in most aquariums this isn't rhythmic and doesn't carry for long (because the aquariums aren't long to begin with). Some new items (like the VorTech featured here, and other water



Wave amplitude. Picture courtesy of Wikipedia

motion devices hitting the market) have the ability to produce wave flow in the aquarium.

Here are some examples of wave devices put into action (these tests were performed in an area 60 inches long, 24 inches front to back, and 16 inches tall. This is 100 gallons of water):

VorTech Undertow: Video 1, Video 2

These videos show the ability of the VorTech pump to draw sediment off the bottom of the aquarium and to lift it into the water column. This type of flow can greatly increase feeding capture of corals as the food stays in suspension and does not settle onto the reefscape.

Making Waves: Video 3

As the VorTech runs it continues to "build up speed" as the inertial forces build and the wave is generated.

Wave Amplitude: Video 4

This video gives you an idea of the amplitude that can be created in a standard 100 gallon system.

Broad Water Flow: Video 5

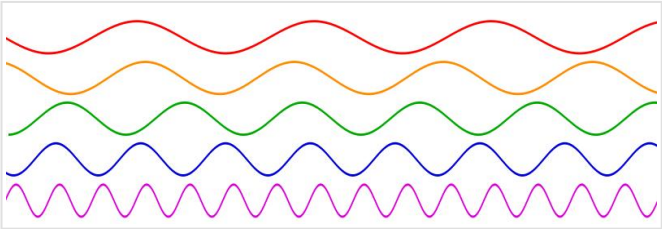
This video shows the broad pattern of water flow from the VorTech. This is especially beneficial in reef aquaria. Notice how the beads stay in suspension and continuously move.

Water Flow 5 Feet From VorTech: Video 6

Shown here is the aquarium on the OPPOSITE side of the running VorTech. What you see here is that the beads are moving around in the water flow created by the pump... from 5 FEET AWAY. In other words one VorTech pump is creating all the flow in this 100 gallon display, and you are seeing the far end of the tank.

The VorTech Display: http://www.youtube.com/watch?v=rLPmea2II-A

Shown here Tim Marks of EcoTech Marine puts the pumps into action in a vendor booth.



Wave frequencies. Picture courtesy of Wikipedia

VorTech Producing Differing Wave Patterns: http://www.youtube.com/watch?v=L9L2FaZwfwo

Jake Adam's video of VorTech's producing a 3rd Harmonic standing wave... the favorite flow pattern of Adam Blundell. The video then shows a transverse or traveling wave. (forgive the music... it is a Jake thing)

Items to Consider

Do we want waves? I guess it depends on whom you ask. Fellow author and water flow guru Jake Adams is a huge fan of laminar flow. I however, am not sold on laminar flow being all that Jake says it is. To me, an oscillating standing wave is the ticket.

Coming To A Conclusion

Flow patterns in aquaria are diverse. At least they can be. Some people like Laminar Flow (Jake) while others like Oscillation (Adam), and the vast majority of aquaria feature Chaotic flow. Why would someone chose one type of flow over another?.... well that question is to be addressed shortly....

Conclusion

While water motion will forever be debated, we can all agree that having options on water flow is always great. Thankfully we now the ability to produce water flow in all sorts of varieties. These options will undoubtedly allow hobbyists to produce the water flow they desire.... whatever it is that they desire.

Author Information

Adam Blundell M.S. works in Marine Ecology, and in Pathology for the University of Utah. He is also Director of The Aquatic & Terrestrial Research Team, a group which utilizes research projects to bring together hobbyists and scientists. His vision is to see this type of collaboration lead to further advancements in aquarium husbandry. While not in the lab Adam provides services for of one of the Nation's largest hobbyist clubs, the Wasatch Marine Aquarium Society (www.utahreefs.com). Adam has earned a BS in Marine Biology and an MS in the Natural Resource and Health fields. Adam can be contacted at adamblundell@hotmail.com.

ONLINE COURSES

AQUARIUM PHOTOGRAPHY

By D. Wade Lehmann

Marine Aquarist Courses Online (MACO) is proud to offer, starting this fall, a two-stage course for aquarium photography.

Published June 2008, Advanced Aquarist's Online Magazine.
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Keywords (AdvancedAquarist.com Search Enabled): D. Wade Lehmann, Online Courses, Photography
Link to original article: http://www.advancedaquarist.com/2008/6/maco

Please visit the website for full details including dates and costs, as well as instructor bio and syllabus.

www.aquaristcourses.org

AQUARIUM PHOTOGRAPHY TECHNIQUES

LEVEL I

Through interactive online learning with practical, hands on photography assignments and critiques of your images through your own student gallery on the MACO website, you will gain a thorough understanding of how to capture stunning photographs of marine or freshwater aquariums and their aquatic inhabitants.

During the Aquarium Photography Techniques - Level I course, you will learn how to utilize your camera equipment (including electronic flash) to capture clear & compelling images of aquariums under different conditions as well as the basic rules of composition and fundamental macro photography techniques.

We will examine how to 'set the stage' in an aquarium for your photo shoot while discussing a variety of techniques for capturing images of a variety of subject matter, including corals, invertebrates, and (of course) fish. We will also cover methods of photographing entire aquarium environments.

The Aquarium Photography Techniques - Level I course will also include an introduction to multimedia uses for your images & methods for displaying and sharing them as well as basic post-production skills, including digital file management and computer manipulation.

LEVEL II

In Aquarium Photography - Level II, utilizing similar interactive, online learning methods, we expand on many of the photographic skills and techniques learned in Level I. We will also learn about the use of some additional, specialized camera equipment and proceed to more specific and advanced techniques required to capture consistently stunning, or professional quality photographs of aquariums and their aquatic residents.

Throughout Level II, you will participate in additional hands-on photography assignments that will allow you to hone and practice your photography new skills. There will be regular critiques of your images through your own student gallery on the MACO website, which will help you to further improve your photography.

During Aquarium Photography Techniques - Level II, you will learn about…

- The use of specialized camera equipment and software for capturing unique, creative images of aquariums and their aquatic inhabitants

- Creating outstanding images through the effective use of visual design elements & imaginative composition
- Creative lighting techniques & specialized lighting equipment that will help you modify the quality of the light and improve your images
- More advanced digital Imaging techniques for enhancing your images and correcting problems you encounter while shooting
- Ways of successfully working with different & difficult subject matter & aquarium set-ups
- Ways you can use your photographs, including how to share and display them for your friends and also how to get your best images published and possibly make some money selling your photos (if you are so inclined)

MACO will also host the return of Fish Husbandry and Reef Chemistry courses! Please check the website for full details including dates and costs. www.aquaristcourses.org

Direct links to each course:

- Aquarium Photography I - http://www.aquaristcourses.org/aqphoto/
- Fish Husbandry - http://www.aquaristcourses.org/Fish%20Husbandry2/

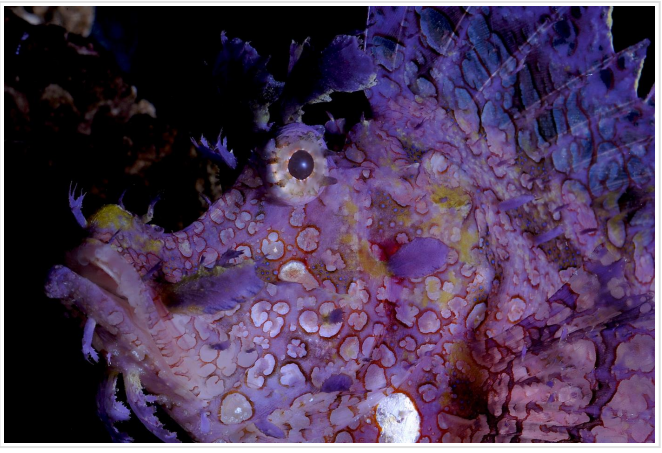
Aquarium Photography Course - Syllabus

Week 1

Introduction

Camera Equipment

- Camera Bodies
- Lenses
- Macro Equipment



- Flash
- Tripods
- Filters

Computers for Photography

Week 2

Creative Use of Camera Controls

- Shutter Speed
- Aperture / f-Stop
- ISO
- Color balance

Digital Imaging 1

- File formats
- File Preparation
- Resolution
- Cropping / Resizing

Week 3

Light

- Reflections & their avoidance
- Lighting
- Electronic Flash

Aquarium Preparation

- Cleaning
- Aquascaping
- Photo-specific tanks

Week 4

Composition

Digital Imaging 2

- Color Correction
- Exposure & Contrast
- Sharpening & Blurring
- Rubber Stamp & Heal

Week 5

Aquatic Subject Matter

- Full Aquarium Photographs
- Aquatic Animal Portraits
- Macro & Close-ups

Introduction to Lighting Theory

Week 6

Uses and Things to Do With Your Photos

- Multimedia & Internet
- Printing

Wrap-up

Prerequisites

- Fundamental knowledge of basic photography
- Fundamental knowledge of computers & file management
- A basic knowledge of working with digital photos on your computer
- Thorough knowledge of the operation of your camera (familiarity with all buttons & modes)

Student Equipment

If you are thinking about purchasing new camera equipment in the near future, please consider postponing your purchases until after our first class, as we will be discussing what to look for in camera equipment.

Required Gear

- Camera body (Much of the course content will be geared toward participants shooting with digital SLR cameras. However, the majority of course content will also be relevant to users of [highly functional] point-and-shoot cameras and those shooting with film.)
- Lens (Most quality, standard lenses will work for this course) (having a variety of focal lengths available will be beneficial)
- Computer (to deal with digital images) (will need sound card and speakers / headphones)
- Photo editing software (class materials will be based on 'Photoshop Elements' but any good photo editing program will likely do)
- Access to an (functioning) aquarium to photograph during the course

Recommended Gear

- Tripod (highly recommended)
- Flash (highly recommended-more than one is helpful)
- Additional lenses (A range of lenses / focal lengths from wide to tele-photo)
- Macro lens
- Scanner (if you are shooting film for class) (or access to a photo-finishing lab that will scan film for you)

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PRODUCT REVIEW

Captive Purity's Reverse Osmosis and Deionization Water Treatment Device

By Dana Riddle

This Captive Purity RO/DI unit generally performs very well, especially when considered the low quality of the feed water. As such, it is worthy of your consideration when making a purchase.

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Keywords (AdvancedAquarist.com Search Enabled): Conductivity, Dana Riddle, Product Review, RO/DI, Salinity, Temperature, Water Quality, Water Testing, pH
Link to original article: http://www.advancedaquarist.com/2008/6/review

Reverse osmosis (RO) and deionization (DI) water treatment processes have found wide spread acceptance among aquarium hobbyists, and especially among reef aquarists, for many reasons. A properly functioning RO/DI unit can deliver water meeting rigid criteria for 'pure' water, does so at a modest price, and requires no operational skills.

As saltwater aquarium hobbyists, we need pure water for a number of reasons. Perhaps the two most important are for ensuring that freshly mixed artificial seawater is not contaminated with various chemicals commonly found in tap water. Secondly, we do not wish to add tap water's chemicals when we 'top off' an aquarium to make up for water loss due to evaporation. Just what is in tap water that we want to avoid?

Figure 1. Not a glamour ad photograph - this Captive Purity Reverse Osmosis Device has treated thousands of gallons of water.

Before answering this question, almost every public and private water supply company is regulated by the Environment Protection Agency (although some very small systems are not). Minimum standards have been set in order to ensure that your drinking water is safe. For instance, water utilities must check the amounts of copper and lead found in drinking water. Copper and lead are usually not found in ground or surface waters, but instead are generally a result of degradation of copper pipes and old solder joints containing lead. If concentrations of lead and copper exceed a given amount in a certain percentage of homes, then the utility must develop and implement a plan to reduce these metals' concentration. This is usually accomplished by chemically treating the water to minimize pipe corrosion, and can be done with a number of compounds, including those containing phosphorus, zinc or tin. After the treatment process has had time to work, the pipes are coated with, say, phosphorus, corrosion is minimized and copper and lead concentrations meet safety standards. Phosphorus is benign and is not a regulated substance in tap water - but it is a critical element for algal growth. Some areas will have naturally occurring compounds such as iron, sulfur, etc., or, as the case here in Hawaii, nitrate and fluoride. This list could go on and on, but I hope the point is clear - we can have safe drinking water, but it is not really acceptable as aquarium water when we want to control algal growths and minimize accumulations of certain elements due to evaporation and contaminated make-up water which results in 'cycles of concentration'.

Captive Purity has been around for a number of years (reference one of their advertisements in a 2000 issue of FAMA), yet their name recognition is not equal (at least to me) to that of some other pet industry suppliers. When considering a replacement of my ancient RO unit, I considered the purchase of several brands. Price was a consideration and Captive Purity's units were substantially less expensive than their competitors. But quality was an unknown. I decided to purchase a Captive Purity RO and DI unit and put it to the test. This would be a tough test too, as the tap water is chlorinated and has a high total dissolved solids (TDS, nearing the EPAs secondary standard of 500 mg/l) content, relatively high chloride (due to saltwater intrusion), silica, and nitrate.

There are many parameters to test when determining water quality. I decided to check for these:

- Conductivity
- Resistivity
- Salinity
- Total Dissolved Solids
- Phosphorus
- Ammonia
- Nitrate
- pH
- Silica

Here are the results for each item:

Conductivity

Conductivity, or Electrical Conductance, is the ability of water to conduct an electrical current, and is reported in units called micro-Siemens per centimeter (µS·cm) at a given temperature (25°C). If the water is really trashed with conductive compounds, conductivity could be reported in milli-Siemens per cm, or mS·cm). It may come as a surprise to many that *ultra-pure* water will, for all intents and purposes, *not* conduct electricity (However, water contaminated with any number of compounds will conduct electrical current - we know that - we're conditioned to the old movie plot where the radio falls into the bath. If the girl in the tub had only used ultra-pure water instead of taking the bubble bath…).

Conductivity is measured with a special sensor, and it is inversely proportional to water purity - the *higher* the conductance, the *less* pure the water is. See Figure 2.

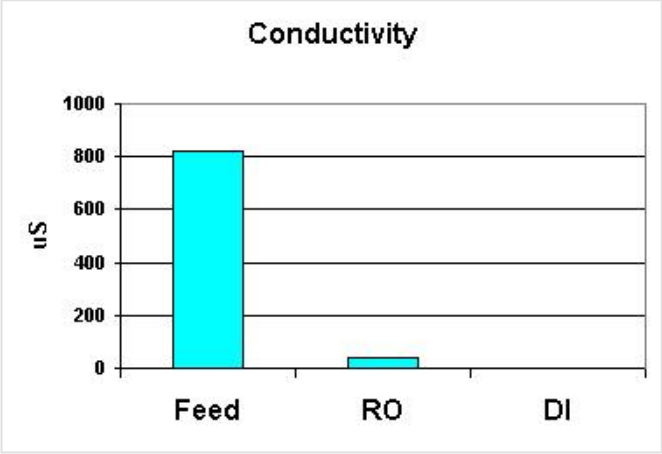

Figure 2. Conductivity of water in various stages of treatment. The DI water measured 0.24 µSiemens·cm - pure water indeed!

Absolutely pure water has conductivity of 0.055 µSiemens·cm. The DI unit initially produced water of 0.24 µSiemens·cm. This meets the requirement of 'pure water.'

Resistivity

Resistivity is the reciprocal to conductivity, and is sometimes considered to be a method superior to conductivity when testing pure water. The *higher* the resistivity, the *higher* the quality of water.

The resistivity of absolutely pure water is 18.2 MΩ·cm (meg-ohm per centimeter). Resistivity values as high as 7.3 MΩ·cm have been noted in the discharge of Captive Purity's deionization unit, but is usually lower (~5.2 MΩ·cm). This value meets the definition of 'pure water'.

As a footnote, the feed water resistivity was 1,219 Ω·cm, and 27.1kΩ·cm for the discharge from the RO membrane (note the prefix to Ω - k, or M, or lack thereof - this makes a huge difference! As would be expected, the feed water has low resistivity, while removal of conductive substances by the RO device increases the resistivity, but only to the kilo-ohm range. Deionization really cleans up the water and boosts the resistivity into meg-ohms).

Salinity

Salinity is usually considered to be a measurement of the mass of dissolved salts in a given mass of solution (water). Simply evaporating the water away and weighing the residual salts is not particularly accurate. Complete chemical analyses are expensive, time-consuming and offer little advantage over the method used in this report: Conversion of conductivity to salinity, using the Practical Salinity Scale 1978. Fortunately, the meter used (Hach HQ40d multi-meter) is programmed with this conversion and a simple push of a button reports salinity in parts per thousand (ppt).

In this case, salinity is due to seawater intrusion into the freshwater aquifer. Freshwater, since it is less dense, floats on seawater beneath this island. This floating freshwater is called the basal lens. When freshwater is rapidly withdrawn (in this case, by pumps supplying drinking water to the island), seawater is locally pulled upwards, and the aquifer is contaminated with saltwater. Obviously, this is not a good situation. Persons limiting their sodium intake are affected, and, when there is not treatment of top-off water in an aquarium, the sodium chloride content increases.

This RO/DI unit was very good in removing salinity. The RO membrane removed 95% of salinity, and the DI cartridge removed some of the remaining salts, with an overall removal rate >99%. See Figure 3.

Total Dissolved Solids, or TDS

TDS is a measure of inorganic salts dissolved in water, and is expressed in units of milligrams per liter (mg/l, which is about the same thing as parts per million). The higher the TDS in mg/l, the higher the concentration of inorganic salts. The EPA has established a secondary, non-enforceable standard of 500 mg/l TDS.

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The feed water to the RO/DI unit was 401 mg/l (80% of the EPAs maximum concentration). See Figure 4.

The discharge permeate from the RO membrane was only 17 mg/l (a 95.7% removal) while the DI effluent contained only 0.041 mg/l (for an overall removal of 99.989% removal of TDS).

NITRATE

Nitrate in many drinking water supplies is relatively high on the Big Island of Hawaii. This is due to leaching of nitrate from relatively young volcanic rock by rainwater; however, the groundwater pumped in this particular district is not among those with concentrations approaching EPAs Primary Standard (enforceable) of 10 mg/l NO_3-N.

Nitrate removal was not as great as those seen with other parameters. The RO unit removed the nitrate with the DI unit removing little, if any. Average nitrate removal was 56% (see Figure 5).

PHOSPHORUS

Phosphorous is sometimes added to a water supply in order to prevent corrosion of water pipes. This is not the case in this instance. Results (not shown in chart form) were at 0.02 mg/l phosphorus (as P), which is below the detection limit of 0.14 mg/l.

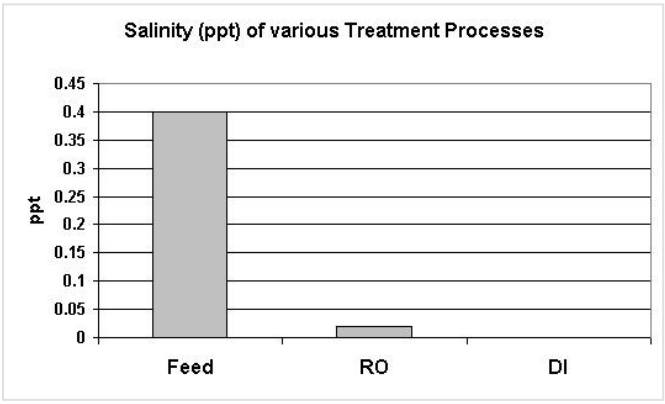

Figure 3. Salinity - inorganic salts - from each treatment stage.

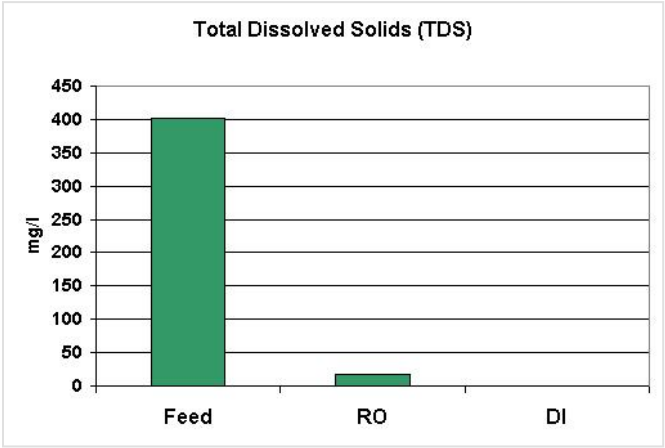

Figure 4. Total Dissolved Solids of water from various stages of treatment.

Therefore, results for all three streams are reported as <0.14 mg/l P.

pH

pH, as we know, is a measure of hydrogen and hydroxyl ions on a scale of 0-14 standard units. A pH value of less than 7 is considered 'acidic' and those measurements above 7 are said to be 'basic'. A measurement of exactly 7 is called 'neutral'. pH is usually checked with an electronic meter using a probe specifically designed to report pH. However, see comments in the 'Methods' section below.

pH values will generally drop as water becomes more pure - this is usually due to removal of alkalinity and substances buffering against the effects of carbon dioxide as it dissolves in the water (carbon dioxide and water mixed makes carbonic acid). It takes very little CO_2 to drop the pH in pure, un-buffered water. See Figure 6.

Silica

There is some controversy over the negative impacts of silica in aquaria. Relatively small amounts apparently cause no harm, but, at higher concentrations, could help promote diatom growths. I have included silica in the testing results since some pet industry suppliers tout their products' abilities to remove silica. Silica (as SiO_2) was monitored on all water streams. The silica concentration of the deionized water read zero, but is reported as <1 mg/l. See Figure 7.

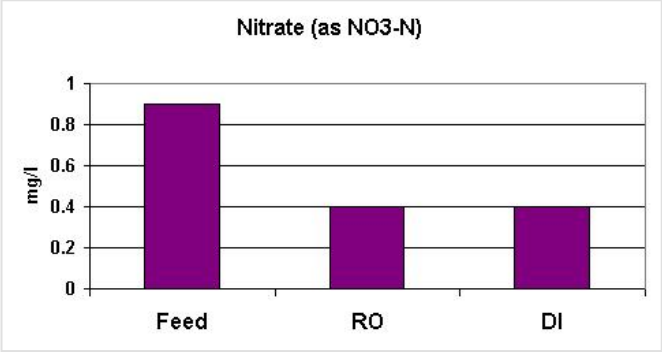

Figure 5. Nitrate removal by the various stages of water treatment.

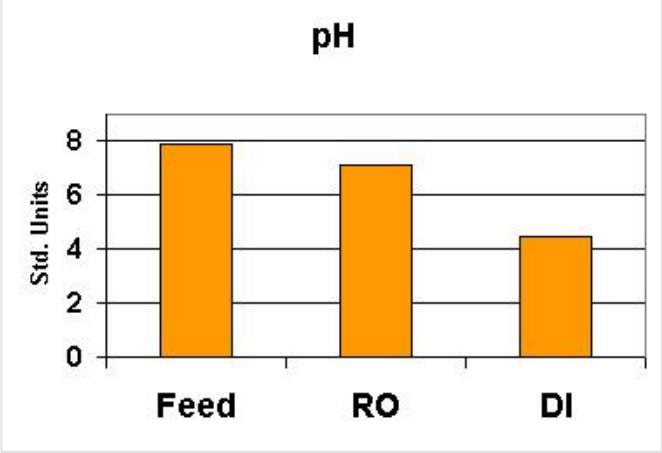

Figure 6. pH of fed water, and discharges from the reverse osmosis and deionization units.

Ammonia

Ammonia concentrations in the feed, RO and DI waters were analyzed using the salicylate method. Ammonia concentrations were below the detection limit of the instrument, and are reported as <0.01 mg/l NH_3 as N (results not shown in chart form).

Temperature

For the record, temperature was monitored on all samples. This is especially importance for conductivity (EC) samples (although the meter used has an automatic temperature compensation feature, EC is reported at a temperature of 25°C - or 77°C). Temperature also affects the performance of the reverse osmosis membrane. Temperatures ranged from 24.1°C to 25.4C° (~75.4 to ~77.7°F).

Production and Rejection Rates

This Captive Purity RO/DI device is rated to produce 75 gallons per day, and came close (~67 gallons/24 hours) after some tweaking. Since production and rejection are competing processes for a given amount of feed water, we should pay close attention to physical variables. Among variables, temperature and water pressure are two important factors to consider when attempting maximizing the efficiency of your RO unit.

A drawback to the reverse osmosis treatment is its water consumption (though it is more efficient in this respect than some water distillation units). The water containing the removed elements is called the 'reject' or 'concentrate' water, and its volume is always greater than the volume of the 'pure' water, or permeate (if the permeate flow suddenly increases, this is an indication that the membrane has failed catastrophically, or that a seal, such as an o-ring, has failed).

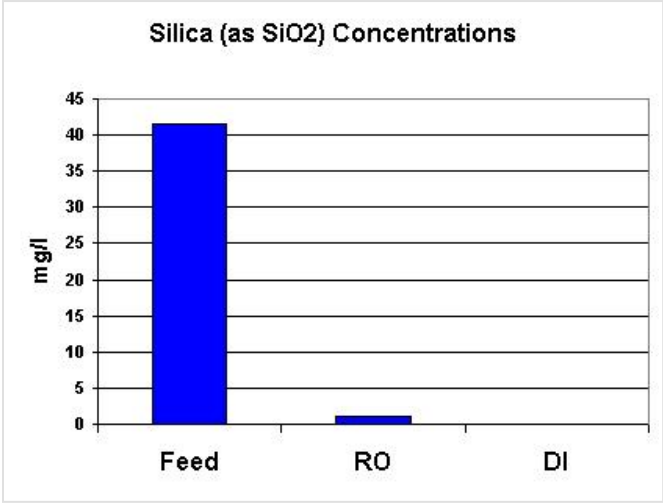

Figure 7. Silica - whether good, bad, or indifferent - is effectively removed by the Captive Purity RO/DI water treatment device.

In my particular case, the RO/DI unit produced pure water at a rate of ~170 milliliters for every 768 mls of feed water, which means, of course, ~598 milliliters were rejected. Your situation may, and most likely will be, different and the amount of product water will be higher. (To give you an idea of how poor the drinking water quality is here, I can taste the salt - the tap water has a flat briny flavor).

Overall Result and Discussion

This Captive Purity RO/DI unit generally performs very well, especially when considered the low quality of the feed water. As such, it is worthy of your consideration when making a purchase.

The strengths of this device are:

1. Price,
2. Availability (it is distributed through a national network),
3. Replacement parts such as carbon, DI cartridges and membranes are also readily available. Replacement fittings are available at any well-stocked hardware store,
4. Though not a physical strength, Captive Purity's advertisements are grounded in fact, and not subject to a great deal of salesman's hyperbole. They understand that the quality of water produced is influenced by the quality of the feed water, and express removal rates as percentages in their ads.
5. Hardware (with the exception of a few screws) is non-metallic and not subject to corrosion.

The weaknesses are:

1. No directions are included,
2. There is no website with instructions or FAQ at the time of this writing
3. The deionization resins are not rechargeable.

Next time, we'll look at what it took to get the most out of this water treatment device (and these recommendations are applicable to any RO unit).

And for hardcore hobbyists:

Methods

A colorimeter (Hach Model 890) was used for testing of nitrate, phosphorus (ortho-phosphate), silica, and ammonia. The procedures involved were cadmium reduction, amino acid, silicomolybdate, and salicylate methods, respectively. See here for an evaluation of this colorimeter: http://www.advancedaquarist.com/2005/6/review/

A meter capable of multiple electronic measurements (Hach H40q) determined salinity, conductivity, resistivity, total dissolved solids and pH (pH of the feed and reverse osmosis permeate). See here for a product review of this instrument: http://www.advancedaquarist.com/2006/10/review/

Electronic measurement of pH in 'pure' water is not recommended unless the pH sensor is specifically designed for pure and/or ultra-pure water - mine is not. So, in the case of the deionized water, pH was determined with a litmus paper strip. See here for a review of various 'test strips': http://www.advancedaquarist.com/2007/4/review/

Comments, suggestions? Reach me at RiddleLabs@aol.com.

ONLINE NEWS

Reefs in the News

From Online News Sources

Media coverage of the state of our world's reefs, interesting information, and other marine-related news.

Published June 2008, Advanced Aquarist's Online Magazine.
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Link to original article: http://www.advancedaquarist.com/marinenews

Fish farm plans irk Lanai anglers (Honolulu Star-Bulletin)

National Marine Sanctuary in the News
June 29, 2008 11:48 AM

WAILUKU » A new aquaculture business wants to raise fish in open ocean off the leeward side of Lanai. But some Lanai fishermen say they're opposed to it because it's located in their main fishing area.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11051d37j/*http%3A//starbulletin.com/2008/06/29/news/story06.html

Fishing bans studied for saving ecosystem (The Sarasota Herald-Tribune)

National Marine Sanctuary in the News
June 29, 2008 11:41 AM

Reeling in a 45-pound grouper used to be just an average day on the water in the Florida Keys.

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National monument designation could save ecosystem (The Charlotte Observer)

Yahoo! Coral Reefs News
June 29, 2008 11:18 AM

One of Earth's last frontiers lies off the Carolinas coast, on the cold, black ocean bottom 1,200 feet below the waves. Scientists are just beginning to explore deep-water coral reefs, possibly millions of years old, that stretch from North Carolina to Florida. They form pristine oases, alive with fish, crabs and weird creatures that one researcher says "look like Dr. Seuss went crazy down ...

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http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11qet15g7/*http%3A//www.charlotteobserver.com/112/story/691112.html

Deep reefs off N.C. captivate scientists (The News & Observer)

Yahoo! Coral Reefs News
June 29, 2008 08:39 AM

Deep-water coral reefs that stretch from North Carolina to Florida have caught the attention of the Bush administration, which is reported to be interested in protecting 25,000 square miles as a national monument.

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http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11mv1p907/*http%3A//www.newsobserver.com/150/story/1124227.html

A farewell to poles? No-fishing zones under study (Contra Costa Times)

National Marine Sanctuary in the News
June 29, 2008 03:21 AM

Marine biologist: 'We were starting to look like a Third World nation in regards to having blitzed our resources"

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http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11pt7aji4/*http%3A//www.contracostatimes.com/ci_9731790?source=rss

State-of-art ship will aid universities in researching Gulf (Houston Chronicle)

National Marine Sanctuary in the News
June 28, 2008 05:49 AM

A fleet new federal research vessel designed to probe the mysteries of the Gulf of Mexico was christened Friday in Galveston, opening previously impossible research opportunities for Texas universities.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=121992kqa/*http%3A//www.chron.com/disp/story.mpl/metropolitan/5861220.html

Maui recognized as Preserve America community (KHNL News 8 Honolulu)

National Marine Sanctuary in the News
June 27, 2008 10:47 PM

KIHEI, Maui (KHNL) - Out of our Earth and Sea file - a special recognition given to the Valley Isle from the White House . Maui has been named a "Preserve America" community.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11igmp8id/*http%3A//www.khnl.com/Global/story.asp?S=8567782

Commerce Announces 2008 Ocean Fishery Council Appointments

NOAA News Releases
June 27, 2008 09:13 PM

The Commerce Department today announced the appointment of 21 members to the eight regional fishery management councils.

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Source:
http://www.noaanews.noaa.gov/stories2008/20080627_council.html

Rivers to Reef: Teachers' Lessons at Sea (WSAV Savannah)

Yahoo! Coral Reefs News
June 27, 2008 08:33 PM

Most teachers aren't working this summer. Some are taking advantage of learning opportunities. We folllowed along as one group headed to Gray's Reef as they learn about our state's waters.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=12ron3803/*http%3A//www.wsav.com/midatlantic/sav/news.apx.-content-articles-SAV-2008-06-27-0013.html

No-fishing zones off Florida Keys studied for ecosystem protection (TCPalm.com)

National Marine Sanctuary in the News
June 27, 2008 04:34 PM

Researchers are studying whether putting large tracts of ocean off-limits to fishing in the Keys can help species rebound — and prove a way to help reverse the effects of overfishing worldwide.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=12qjvm4u9/*http%3A//tcpalm.com/news/2008/jun/27/no-fishing-zones-florida-keys-studied-ecosystem-pr/

New High-Tech Research Ship to Serve NOAA's Flower Garden Banks Sanctuary

NOAA News Releases
June 27, 2008 02:25 PM

Today, NOAA christened a new, state-of-the-art research vessel that will enhance the study and protection of Flower Garden Banks National Marine Sanctuary in the Gulf of Mexico. The 83--foot R/V Manta will operate out of Galveston, Texas, where the sanctuary is headquartered.

Read More...

Source:
http://www.noaanews.noaa.gov/stories2008/20080627_flowergarden.html

NOAA: Seven Stocks Removed from Overfishing Lists, None Added

NOAA News Releases
June 27, 2008 01:08 PM

NOAA announced today that seven stocks have been removed from the overfishing list and no new stocks added in their annual report to Congress on the status of fishing stocks.

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Source:
http://www.noaanews.noaa.gov/stories2008/20080627_stocks.html

Maui designated as state's first 'Preserve America Community' (The Maui News)

National Marine Sanctuary in the News
June 27, 2008 10:39 AM

Mayor Charmaine Tavares and John Nau, chairman for the Advisory Council on Historic Preservation and Preserve America initiative, arrived at the Hawaiian Islands Humpback Whale National Marine Sanctuary on Thursday morning in canoes. Tavares and Nau were announcing the designation of Maui as the state's first "Preserve America Community." The designation will allow the county to apply for up t

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11u9q00e3/*http%3A//www.mauinews.com/page/content.detail/id/505359.html

Dry Tortugas Show Positive Trends: Protected Area Slowly Rebounding

ScienceDaily: Coral Reef News
June 27, 2008 06:00 AM

Thirty-eight research divers recently completed a successful 20-day biennial census to measure how the protected status of the Florida Keys National Marine Sanctuary's Tortugas Ecological Reserve and Dry Tortugas National Park's Research Natural Area are helping the regional ecosystem rebound from decades of overfishing and environmental changes.

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Source:
http://www.sciencedaily.com/releases/2008/06/080623113728.htm

Fort Pierce native hopes to save coral reefs by studying them (Fort Pierce Tribune)

Yahoo! Coral Reefs News
June 27, 2008 04:19 AM

From magical seascapes to colorful native peoples right out of the pages of National Geographic, Tanya Ribakoff documented her adventures from Fort Pierce to Fiji, Vanuatu to New Zealand, as the scientific coordinator aboard a research vessel studying the world's coral reefs.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=13gfodi70/*http%3A//tcpalm.com/news/2008/jun/27/30gtfort-pierce-native-hopes-to-save-coral-reefs/?partner=yahoo_headlines

UQ's CoralWatch joins forces with international reef monitoring program. (University of Queensland)

Yahoo! Coral Reefs News
June 27, 2008 03:18 AM

UQ's research project 'CoralWatch' is joining the UN's official community-based reef monitoring program, Reef Check, to assess the health of local coral reefs in South East Queensland.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11mii8j2e/*http%3A//www.uq.edu.au/news/index.html?article=15143

Maritime Festival takes place July 4 (The Alpena News)

National Marine Sanctuary in the News
June 27, 2008 02:39 AM

Ship tours and boat building demonstrations are among the highlights of the eighth annual Thunder Bay Maritime Festival on July 4. The festival will take place from 10 a.m.-6 p.m. at the Thunder Bay National Marine Sanctuary. The event is free to the public. "This is an event for the community.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=123n12rjm/*http%3A//www.thealpenanews.com/page/content.detail/id/501937.html

New Interactive Touch-Screen Kiosks Offer In-depth Look at NOAA's Channel Islands Sanctuary

NOAA News Releases
June 26, 2008 07:58 PM

Santa Barbara and Ventura County residents and visitors can now explore Channel Islands National Marine Sanctuary without getting their feet wet through new state-of-the-art touch screen NOAA kiosks located at four sites along the coast.

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Source:
http://www.noaanews.noaa.gov/stories2008/20080626_kiosks.html

Hausner 'reef' hooks up with San Jose museum (J. the Jewish News Weekly of Northern California)

Yahoo! Coral Reefs News
June 26, 2008 07:04 PM

didn't stop the seventh-graders at Gideon Hausner Jewish Day School from creating a reef of their own.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=139k17r0q/*http%3A//www.jewishsf.com/content/2-0-/module/displaystory/story_id/35538/format/html/displaystory.html

Spotting the killer hot spots (PhysOrg)

Yahoo! Coral Reefs News
June 26, 2008 06:42 PM

Killer hotspots of over-heated ocean water which destroy huge areas of coral and bring starvation to birds, fish and other sea creatures can now be pinpointed, thanks to a major advance in the use of satellite technology by Australian and American researchers working under the Marine and Tropical Sciences Research Facility (MTSRF) program.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11dn5gjfo/*http%3A//www.physorg.com/news133709357.html

Florida may ban fishing in some areas (Daily Herald)

National Marine Sanctuary in the News
June 26, 2008 06:14 PM

Reeling in a 45-pound grouper used to be just an average day on the water in the Florida Keys. The abundance of behemoth fish attracted anglers from around the world in the early 1900s, including adventurers such as Ernest Hemingway and Zane Grey.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11n6khjkq/*http%3A//www.dailyherald.com/story/?id=212503&src=109

Save Our Shores: Santa Cruz County News Briefs (Metro Santa Cruz)

National Marine Sanctuary in the News
June 26, 2008 05:43 PM

Save Our Shores rallies against offshore oil rigs (again), Tony Madrigal pares down dreams for Santa Cruz-wide wi-fi coverage and Scotts Valley prepares to nix Styrofoam.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=129ccf1d6/*http%3A//www.metrosantacruz.com/metro-santa-cruz/06.25.08/nuz-0826.html

No-fishing zones studied for ecosystem protection (AP via Yahoo! News)

National Marine Sanctuary in the News
June 26, 2008 04:09 PM

Reeling in a 45-pound grouper used to be just an average day on the water in the Florida Keys.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=1202kksa6/*http%3A//news.yahoo.com/s/ap/20080626/ap_on_re_us/fish_haven_5

Aquarius divers begin new mission (The Seahawk)

Yahoo! Coral Reefs News
June 26, 2008 04:05 PM

Scientists at the National Undersea Research Center at UNCW are looking to the future, below the surface. Divers at the Aquarius Reef Base, the underwater ocean laboratory in Florida, began their fourth mission of 2008 in June. Since very little is known about the biological reasons why one coral may survive in a new habitat after rescue and transplantation and one may sicken and ...

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=132eccuab/*http%3A//www.theseahawk.org/news/2008/06/26/News/Aquarius.Divers.Begin.New.Mission-3385746.shtml

Science in a flap over fish (Herald Sun)

Yahoo! Coral Reefs News
June 26, 2008 02:00 PM

TINY reef fish that speed through the water at up to 10 body lengths per second could inspire the next generation of underwater exploration.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=12np3caks/*http%3A//www.news.com.au/heraldsun/story/0,21985,23928794-662,00.html?from=public_rss

No fishing allowed: Scientists study whether off-limits zones can help revive fish populations (Minneapolis-St. Paul Star Tribune)

National Marine Sanctuary in the News
June 26, 2008 09:00 AM

DRY TORTUGAS NATIONAL PARK, Fla.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/%22National+Marine+Sanctuary%22/SIG=11kpjna9j/*http%3A//www.startribune.com/science/21697909.html

Film events (Detroit Free Press)

Yahoo! Coral Reefs News
June 26, 2008 07:19 AM

Detroit Science Center (IMAX Dome Theatre): Films at the IMAX, "Grand Canyon Adventure: River at Risk," "Mummies: Secrets of the Pharaohs," "Dolphins" and "Coral Reef Adventure." Call for daily times. 5020 John R, Detroit. 313-577-8400. www.detroitsciencecenter.org.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=12c4cfm2g/*http%3A//www.freep.com/apps/pbcs.dll/article?AID=/20080626/ENT01/806260311

Scientists find new way to help avert reef coral bleaching (ABC via Yahoo!7 News)

Yahoo! Coral Reefs News
June 26, 2008 04:25 AM

New research could help protect the Great Barrier Reef from mass coral bleaching.

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Source:
http://us.rd.yahoo.com/dailynews/rss/search/coral+reef/SIG=11h672js1/*http%3A//au.news.yahoo.com/080626/21/17g6c.html

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At AquaCave, we offer a large selection of aquarium supplies for both, freshwater and saltwater enthusiasts. The prices and quality of our aquarium equipment keep our customers coming back. We stock thousands of aquarium supplies such as protein skimmers, air pumps, water pumps and power heads, full line of CO_2 equipment, calcium reactors, aquarium lighting, fish food, refugiums, aquarium filters, heaters, and much more. New items are added daily so please visit us often to get the latest high quality products at great prices.

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HelloLights has been in business since 1997 providing the aquarium industry with high quality lighting products and accessories. Throughout the years, our mission has been to be the aquarium hobbyist? one stop source for all of their lighting needs. With unsurpassed customer service and high quality products, we truly believe we are the clear choice for aquarium lighting. We realize that lighting is one of the major purchases that the hobbyist will make when setting up an aquarium, and we take great pride in our role in this process.

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MarineDepot.com is the current leader in supplying marine and reef aquarium supplies. We simply try to make as many people (including both our staff and our customers) as happy as possible. We found that we have been able to accomplish this by maintaining extremely low prices, providing friendly customer service, and simply liking what we do.

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Premium Aquatics is a family owned and operated aquarium business. We have been in business since April 1996 and we are dedicated to serving the aquarium hobbyist. Our mission is to bring you the highest quality aquarium products and livestock available and at a reasonable price and to provide honest non-bias information on all of our products and our competitors. Our goal is customer satisfaction, we want your return business.

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Our goal is to provide only the best aquarium supplies available and to promote successful and responsible husbandry for all of our aquarium animals. We stock hundreds of the best aquarium and reef supplies and constantly growing. Some of which include, protein skimmers, chillers, calcium reactors, reverse osmosis systems and replacement filters and we specialize in reef tank lighting. We are adding to our inventory daily so be sure to visit us often.

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The Two Part Solution is a method of adding calcium, alkalinity and magnesium to your reef aquarium. What's unique about this solution is many of the items used are household items or just bulk supplies of the very same products you are buying two cups of for $20 just because it has a fancy package. It has been time tested by thousands of aquarists and proven to not only be incredibly effective and easy to use but also extremely affordable. There is simply no other balanced calcium, alkalinity and magnesium solution out there that is so ridiculously cheap and has no expensive and intimidating equipment to buy.

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Quality Aquarium supplies, equipment, and livestock at reasonable prices. J&L Aquatics was formed in December 1997. Our business was started from our love of the aquarium hobby. We at J&L Aquatics felt that the Canadian aquarist should have the option to purchase top quality supplies, equipment and livestock other than the generally over priced local retail stores. With this philosophy in mind we have successfully operated and grown our business for the past five years.

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We started almost a decade ago on a small place in south Florida now, over the years Marine Garden not only have grown but had developed new techniques on keeping corals and Fishes as healthiest as if they were on the Ocean. Most of our corals are 100% captive grown by ourselves or other Professional hobbyists. By purchasing aqua cultured corals, since they use to be in captivity you are getting not only the best quality but also a stronger and harder specimen. Also, you will be helping to minimize the problem of the declining coral reefs in our oceans

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Reef Nutrition Marine Live Feeds are produced by Reed Mariculture, the world's largest producer of marine microalgae concentrates. We supply algal feeds and zooplankton to universities, marine ornamental growers, and over 500 fish, shrimp, and shellfish hatcheries in 70+ countries around the world.

Southern California Caulerpa Action Team

An important goal of the Southern California Caulerpa Action Team is the detection of undiscovered infestations of C. taxifolia or other invasive species of Caulerpa, and the prevention of their spread.

Sunlight Supply, Inc.

Sunlight Supply Inc. is a manufacturer and importer of High Intensity Discharge (H.I.D.) and fluorescent lighting fixtures. We specialize in fixtures with applications in the hobby & commercial horticulture and reef tank aquarium industries. Sunlight Supply Inc. is a recognized and respected leading brand in the marketplace.

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We are the original Aquatic and Pet Supply Superstore! Every year, tens of thousands of visitors come from all over the US and Canada to explore our 110,000 square foot retail store. Bring your pet along and check out our incomparable fish room with over 800 aquariums!

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AquariumPart.com is an online retailer of many hard to find parts for various aquarium lights, pumps, protein skimmers, meters, UV sterilizers and filters.

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Phishy Business

Phishy Business is a reef livestock mail order company dedicated to captive propagation of soft and SPS corals.

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A leader in the development and introduction of new and innovative technologies and products for the serious aquarium hobbyist.

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WHERE REEFKEEPING BEGINS ON THE INTERNET

"www.reefs.org - If you had to pick a "one-stop shop" for everything online for reefs, this would be it. If you can't find it here, you can't find it." – Richard Sexton, Tropical Fish Hobbyist, November, 2002

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